

What happens when children with attention deficit/hyperactivity disorder grow up?

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Attention deficit/hyperactivity disorder¹ and the associated hyperkinetic disorder,² hereafter both referred to as ADHD, are the most prevalent and best researched of all the childhood mental illnesses. Although not diagnostically identical, the combined type ADHD and ICD-10 hyperkinetic disorder have sufficient in common for research into the two to be considered in parallel. They are, as we shall see, common, disabling and probably neurobiologically based. The received wisdom over the years has been that ADHD is a disorder of childhood whose symptoms lessen over time;^{3,4} consequently little attention was paid to the possibility that it might continue into adulthood. But is this old consensus correct? What does happen to the children who have ADHD?

The diagnosis and treatment of ADHD is a perplexing area for the child and adolescent psychiatrist, and in the opinion of some clinicians and researchers the check-lists of the DSM-IV and ICD-10 do little justice to the psychosocial and behavioural aspects of hyperkinetic activities.⁵ Moreover, review of the published work is hampered by the numerous changes in diagnostic criteria over the years.⁶ The notion that ADHD phenomena reflect other disorders, rather than being core components of a nosologically separate identity, persisted (particularly in the UK) long after the discovery by Bradley in 1937 that stimulant medication has a calming effect on hyperactive children.⁷ However, as the diagnostic tools have become more robust and the evidence to support pharmacological treatment has become stronger, the doubters are now in a minority. The attention dyscontrol–impulsivity–hyperactivity triad is widely accepted not only as a formal mental disorder but also as one whose diagnosis and management, both pharmacological and psychosocial, can offer profound benefit for the child and family.

Because ADHD was diagnosed and managed principally by child and adolescent psychiatrists, the long-term fate of the patients suffered relative neglect. The likelihood of remission seemed to be supported by a steady reduction in symptoms over time.⁸ However, the dearth of information has been substantially remedied over the past two decades and the possibility of ADHD as an adult diagnosis is gaining

ground—opening treatment options for those affected. This paper explores existing knowledge and potential areas for further research.

EPIDEMIOLOGY OF CHILD TO ADULT ADHD

Most of the epidemiological studies into ADHD and its longitudinal trajectory have been conducted in the Americas and the UK. In children, ADHD is known to be a common condition: the prevalence of hyperkinetic disorder in 7-year-old boys in an inner-city British sample was 1.5%.⁹ A community sample from Puerto Rico of children under 11 yielded a higher prevalence, 6.7%,¹⁰ whilst that in an American paediatric population was 9.5%.¹¹ In a German survey of elementary school children, DSM-III criteria indicated a 9.6% prevalence of attention deficit disorders; however, use of DSM-IV raised this to 17.8%.¹² Clearly, some of the differences in reported prevalence are due to variations in the severity and breadth of characteristics included. The ICD-10 diagnosis of hyperkinetic disorder is more restrictive than its DSM counterpart; it compares best with ADHD-combined type, which partly explains the lower prevalence in places (such as the UK) where ICD-10 is used as the diagnostic tool. ADHD is generally held to have a prevalence of between 2% and 8% in school-aged children. In certain populations of children—including those in offender units and those with strong family histories of ADHD—the prevalence of ADHD is exceptionally high. Garland *et al.*¹³ looking at a high-risk community sample in San Diego, California, found ADHD and/or disruptive behaviour disorders in as many as half the children.

If ADHD were largely confined to childhood we would expect to see the prevalence rates dropping sharply in late adolescent samples. The epidemiological research to date does not indicate such a phenomenon. In an American community sample of children in their final year at school (mean age 18 years) the prevalence was 1.5% overall, and 2.6% in the males.¹⁴ Furthermore, prospective studies of ADHD children show that, although there is a trend towards amelioration of symptoms, a substantial proportion continue to have at least one disabling symptom in adolescence and young adulthood. A New York cohort of children aged 6–12 with ADHD was followed up

longitudinally, and after 10 years about a quarter still met the diagnostic criteria.¹⁵ A similar study in Montreal gave even more striking results; two-thirds of children with ADHD continued to be disabled by the disorder in early adulthood.¹⁶ There is little doubt that, for some at least of those affected in childhood, ADHD continues into adult life.

AETIOLOGY

If ADHD is related to developmental dysfunction of the brain, we would not expect it simply to 'go away' in adulthood. The phenotypic manifestations might be altered by the person's environment but the underlying deficit would persist. Such evidence of neurobiological changes has emerged from structural neuroimaging in the brains of children, teenagers and adults. With MRI, Hynd *et al.*¹⁷ noted abnormalities in the frontal lobes of patients with ADHD, most pronounced in the right frontal lobe. Others report abnormalities of the caudate nucleus, with reversal of the normal asymmetry whereby the left basal ganglia are larger than the right.¹⁸ A decrease in the volume of the corpus callosum has been described, perhaps signifying subnormal interhemispheric connectivity.¹⁹ These variations from normal are in areas associated with control of motor activity and the proposed 'attention centres'—exactly the areas where abnormalities would be expected in these patients. These results, however, await replication by other groups.

Other information has come from functional neuroimaging with positron emission tomography. Zametkin *et al.* studied adults²⁰ and children²¹ with ADHD to see whether glucose metabolism in their brains differed from that in normal controls. Both adults and children with ADHD proved to have subnormal metabolism in the premotor and superior frontal cortex. Again this finding has yet to be replicated.

There is also strong evidence that perinatal insults increase the prevalence of ADHD. In a case-control study Mick and others found a 2-fold increase associated with prenatal smoking and a 2.5-fold increase associated with *in-utero* exposure to alcohol.²² The same group also found case-control evidence for a correlation between low birthweight (<2500 g) and an up to 3-fold excess risk of ADHD.²³ Their work built on earlier reports²⁴ suggesting that these three factors are all potential causes of neurological damage leading to the phenotypic picture of ADHD.

The final biological link in the aetiological chain comes from twin studies, with their ability to differentiate environmental from genetic influences. In a study of monozygotic (MZ) and dizygotic (DZ) twin pairs Goodman and Stevenson²⁵ showed a MZ:DZ ratio of 51:33, and from

this they extrapolated the heritability of inattention and hyperactivity traits to be in the region of 30–50% compared with a 0–30% influence for environmental factors.

Despite the above evidence, the neurobiological theory of ADHD is well short of proof. As indicated, much of the work is preliminary, and replication when attempted has not always been successful.²⁶ With imaging reports readers need to bear in mind the vast amount of information analysed and the fact that, with conventional statistical testing, 'significant' differences are to be expected for one of every twenty comparisons. Zametkin *et al.*, for example, looked at 60 areas of the brain and found differences in only 4 (3 would be expected by chance alone). We must also consider the possibility that such changes are the result of the illness (with repeated insults to the brain) rather than the cause.

THE FEATURES OF ADHD AS CHILDREN GROW UP

If we accept the evidence for continuation of ADHD beyond childhood, we need to clarify the features of this disorder in adults and how it affects their ability to function in society. Diagnosis in adults is hampered by a lack of clear guidelines for the clinician. For example, the DSM-IV criteria¹ were designed to apply to children, and adults were not included in the field trials.²⁷ Nevertheless a systematic review suggests that ADHD can be reliably identified and diagnosed in the adult population.²⁸

The core triad of features—inattention, impulsivity, hyperactivity—applies to both children and adults, and they are chronic and stable.²⁹ A reported reduction in symptoms with advancing age may be explained by acquisition of cognitive strategies to ameliorate these features.³⁰ In adults, inattention and impulsivity seem more stable markers of ADHD than hyperactivity. Poor concentration at work (and during enjoyable leisure activities), daydreaming and forgetfulness suggest inattention, whilst poor tolerance to frustration, easy loss of temper and exceptional impatience suggest inattention and impulsivity. Hyperactive manifestations such as fidgeting and restlessness may also be present. These features can lead to difficulties in interpersonal relationships, in maintaining a satisfactory work record and in enjoying life in general. Such symptoms can, of course, arise in anyone at some time. Prerequisites for the adult diagnosis are temporality (i.e. the symptoms must have been present since childhood), pervasiveness and functional impairment. Unfortunately, the instruments developed to aid diagnosis are not totally specific and are particularly error-prone in patients with comorbid psychiatric illness. Furthermore, the boundary between ADHD and antisocial personality disorder is unclear; for both, the essential criteria include presence since childhood, functional

impairment, interpersonal difficulties and intrapsychic distress. Just as in young populations where hyperactive children may in fact have a primary behavioural disorder, not all inattentive or impulsive adults should be assumed to have ADHD.

To help resolve the clinical dilemmas, four rating scales have been developed from the child criteria in DSM-IV, and each has been found valid.³¹ The adult attention deficit disorder evaluation scale (A-ADDES), developed by McCarney and colleagues is most closely related to the child criteria whereas the Brown Attention Deficit Disorder Scales and the Attention Deficit Scales for adults give more emphasis to the temporal and cognitive features of the adult presentation of ADHD. The Wender–Utah self-rating scale, which looks at the symptoms of ADHD against an adult background,³² can be used to make a retrospective diagnosis of ADHD in childhood, thus fulfilling the requirement for temporality. There is little to choose from between these scales, however.

SOCIAL DIFFICULTIES FOR THE ATTENTION-DEFICIENT ADULT

Clearly, the cognitive and functional defects associated with ADHD in adults will lead to social and interpersonal difficulties. The path of adolescents with ADHD continues the childhood trend of divergence from that of their peers. They perform worse at school and are at greater risk of suspension or expulsion.³³ Doubtless in consequence, the occupational achievement of young adults with ADHD is poorer than that of matched peers.³⁴ However, possibly the most disabling aspect of ADHD in adulthood is the disruption it causes in interpersonal relationships, with increased risk of chronic conflict with work peers, socially inappropriate behaviours, disputes with partners and spouses and trouble with the law.³⁵

Troubles at home in maintaining and sustaining family relationships are most sharply highlighted in the prospective sample followed up by Weiss and Hechtman.³⁶ The difficulties arose not only from the personal struggle to maintain relationships but also from the problems of coping with their similarly affected children. Moreover, adults with ADHD seem to produce more than the average number of offspring,³⁷ and an individual who personally struggles with inattention and impulsivity will have difficulty in mustering the parenting skills to deal with an ADHD-disordered child. Clearly there is substantial social morbidity in this group.

COMORBID PSYCHIATRIC SYMPTOMS IN ADOLESCENTS AND ADULTS

So many people with ADHD have coincident depression that some workers suggest that genetic risk factors for the two illnesses may be similar.³⁸ Up to 16% of adults with

depression have been reported as having ADHD,³⁹ so the pharmacological treatment of adult ADHD with antidepressants has received considerable investigation. There is also some evidence that ADHD is correlated to recurrent brief depression—a disorder whose aetiology may differ somewhat from that of classic depression.⁴⁰

The rate of substance misuse in the ADHD population is also said to be raised.⁴¹ Not all researchers, however, have confirmed this association and some have noted it only in adults who continue to experience core symptoms of ADHD.¹⁵ Alcohol consumption in pregnancy is a risk factor for ADHD, so perhaps one disorder predisposes to the other or they are intertwined. Since conduct disorder is associated with ADHD in children it is not surprising that adolescents with ADHD tend to show antisocial personality traits.⁴² This is reflected in the greater rates of criminal involvement in young adulthood.⁴³ The correlation between ADHD and adult psychiatric comorbidity is stronger in females than in males: girls with ADHD had a greater risk of psychiatric admissions in adulthood and this was significantly increased if they also had a history of conduct problems.⁴⁴

The research to date, although not conclusive, points to a link between ADHD in adults and a broad range of other psychiatric ills—notably affective, substance-misuse and antisocial disorders. Probably most adults with ADHD seek advice from primary care or psychiatric services at some point in their lives, and in a patient with alcohol dependence or personality disorder the ADHD is easily missed. Clinically the diagnosis is important to make in view of the prognostic and treatment implications.

MANAGEMENT OF ADULT ADHD

Since ADHD in adults adversely affects work, interpersonal relationships and ability to function constructively and happily within society, effective interventions might have a strongly positive effect on the trajectory of an individual's life and benefit society at large. As children treated with stimulants for ADHD approach adulthood, the usual practice (underwritten by guidelines from the National Institute for Clinical Excellence) is to try them off medication periodically to see if it is still required. At this time the external pressure to treat, from schools and parents, is likely to be easing, so that the young adult becomes the sole decision-maker. Also most stimulants are licensed only for use in children, and care is transferred to teams serving adults. Thus, treatment usually stops. It is unsurprising, then, that the main focus of interest has been pharmacological treatment, with the emphasis on stimulant medications of the sort used in children. So far, however, only fifteen controlled studies of stimulants have been reported in adults, compared with over a hundred in the

child population. With methylphenidate the response rates ranged from 25%⁴⁵ to 78%⁴⁶ (compared with about 70% in children). The weakness of these studies lies in the absence of widely recognized diagnostic criteria, instruments to measure efficacy and 'therapeutic medication range'. In a novel approach, the possible role of nicotine has been investigated. Conners *et al.*⁴⁷ found significant improvements in the symptoms of adults with ADHD using a 7 mg/day transdermal patch. If confirmed effective, this strategy will offer the additional advantage of helping patients who smoke to stop; the general health benefits of smoking cessation tend to be underrated in psychiatric practice.⁴⁸

Non-stimulant medications have attracted more interest in adults than children with ADHD, especially antidepressants, but no long-term randomized trials of commonly used antidepressants have been reported. Noradrenergic antidepressants have also been reported beneficial in early work, but not all experts are persuaded: Wender argues that adults with ADHD are more prone to the side effects of these compounds and that there is no overall benefit.⁴⁹

In children the possibility of using antihypertensives has been explored and clonidine is considered a useful second-line when stimulants are contraindicated (e.g. in severe tic disorders). Clonidine has not been investigated in adults with ADHD. Some small studies suggest benefit from beta-blockers against impulsive symptoms.⁵⁰ The novel antidepressant bupropion has also been shown effective in treating the core adult ADHD symptoms,⁵¹ and this is particularly noteworthy in view of the stimulant-like structure of this drug. Clarification of the value of nonstimulant medication in this group of patients is important since many are substance misusers in whom stimulant therapy is undesirable.

Medication is not the only therapeutic option, though it is much more fully researched than others. Several experts in the area of adult ADHD back the use of psychotherapeutic interventions. Also, positive results are emerging from cognitive approaches to the treatment of adult ADHD.⁵²

CONCLUSION

ADHD is a disorder whose features change over time but which commonly persists into adult life. Recognition of this fact will lead to wider diagnosis and better treatment. For adults with ADHD the future is much brighter than it was even ten years ago.

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